

CLAIMS

What is claimed:

1. A method for supporting a substrate during programmed material consolidation of one or more objects on or adjacent to the substrate, comprising:
securing the substrate in position over a support surface; and
preventing unconsolidated material from contacting a bottom surface of the substrate.

2. The method of claim 1, wherein securing the substrate in position over the support surface is effected by positioning the substrate at least partially within a receptacle formed by at least one raised element.

3. The method of claim 2, wherein securing the substrate in position over the support surface includes disposing a retention lip extending laterally from the at least one raised element over at least a portion of a periphery of the substrate.

4. The method of claim 3, wherein the retention lip contacts at least the portion of the periphery of the substrate.

5. The method of claim 4, further comprising:
positioning at least one spacer between the support surface and the bottom surface of the substrate.

6. The method of claim 3, wherein disposing the retention lip comprises forming the retention lip by programmed material consolidation processes.

7. The method of claim 6, wherein forming the retention lip by programmed material consolidation processes includes employing stereolithography.

8. The method of claim 3, wherein disposing the retention lip comprises positioning a preformed retention lip over at least a portion of a periphery of the substrate.

9. The method of claim 2, wherein positioning the substrate comprises positioning the substrate within a receptacle formed by at least one raised element that substantially surrounds the at least one substrate.

10. The method of claim 9, further comprising:
disposing at least one extension element on an upper surface of the at least one raised element.

11. The method of claim 10, wherein disposing the at least one extension element comprises fabricating the at least one extension element by programmed material consolidation processes.

12. The method of claim 11, wherein forming the at least one extension element by programmed material consolidation processes includes employing stereolithography.

13. The method of claim 2, wherein securing the substrate in position over the support surface includes applying a negative pressure to the bottom surface of the substrate.

14. The method of claim 13, wherein securing the substrate in position over the support surface further includes positioning the substrate over a sealing element with a peripheral portion of the bottom surface of the substrate contacting the sealing element.

15. The method of claim 14, further comprising:
breaking a seal between the sealing element and the bottom surface of the substrate.

16. The method of claim 1, wherein securing the substrate in position over the support surface includes applying a negative pressure to the bottom surface of the substrate.

17. The method of claim 1, further comprising:
removing the substrate from the support surface.

18. The method of claim 17, wherein removing the substrate comprises applying a positive pressure to the bottom surface of the substrate.

19. The method of claim 18, wherein applying a positive pressure to the bottom surface of the substrate includes creating a circulating air flow beneath the bottom surface of the substrate.

20. The method of claim 19, wherein creating a circulating air flow beneath the bottom surface of the substrate causes the substrate to hover over the support surface.

21. The method of claim 17, wherein removing the substrate comprises applying force to the bottom surface of the substrate.

22. A programmed material consolidation method, comprising:
positioning at least one substrate in a receptacle of a retention system including a raised periphery that laterally surrounds the at least one substrate;
introducing unconsolidated material onto a surface of the at least one substrate; and
programmably consolidating at least portions of the unconsolidated material.

23. The programmed material consolidation method of claim 22, wherein introducing unconsolidated material comprises forming a layer of unconsolidated material of desired thickness over the at least one substrate, then selectively consolidating regions of the layer.

24. The programmed material consolidation method of claim 23, wherein introducing unconsolidated material further comprises repeating the acts of forming and selectively consolidating at least once.

25. The programmed material consolidation method of claim 22, wherein introducing unconsolidated material includes substantially filling the receptacle with unconsolidated material.

26. The programmed material consolidation method of claim 25, further comprising: planarizing a surface of the unconsolidated material within the receptacle.

27. The programmed material consolidation method of claim 26, wherein planarizing is effected with at least one of a meniscus blade and an air knife.

28. The programmed material consolidation method of claim 22, wherein introducing unconsolidated material comprises spraying unconsolidated material onto at least a portion of the at least one substrate.

29. The programmed material consolidation method of claim 22, wherein introducing unconsolidated material comprises dispensing the unconsolidated material in a laminar flow.

30. The programmed material consolidation method of claim 29, wherein dispensing is effected without introducing unconsolidated material onto structures that protrude from the at least one substrate.

31. The programmed material consolidation method of claim 22, further comprising: removing excess unconsolidated material from the recess following the programmably consolidating.

32. The programmed material consolidation method of claim 22, further comprising: preventing unconsolidated material from contacting a bottom surface of the at least one substrate while introducing unconsolidated material into the receptacle.

33. The programmed material consolidation method of claim 22, further comprising:
removing the at least one substrate from the receptacle following programmably consolidating at
least portions of the unconsolidated material.